

2. CONTRIBUTIONS FROM THE BIOLOGY DEPARTMENT OF
THE UNIVERSITY OF WESTERN AUSTRALIA.

No. 10.

Notes on the Male Generative apparatus of *Tarsipes spenserae*.

(With Eight Figures, 1-8.)

By

D. ROTENBERG, B.Sc.

And an Appendix by

L. GLAUERT, B.A.

(Read 14th August, 1928. Published 27th March, 1928.)

Owing to its primitive nature the marsupial urogenital apparatus holds a very great interest for the student of the mammalia. There exist many excellent accounts of this apparatus for certain marsupials but I can find no record of any paper on the male organs of *Tarsipes spenserae*, albeit Hill¹ has given a full description of the female genitalia of this animal.

This little West Australian marsupial, is, unfortunately, becoming extremely rare, and as I have recently had access to a small collection of these animals which included several male specimens it has seemed desirable to offer a short description of the generative apparatus, so far as I have been able to make it out from the material available.

In all, five specimens were examined but unfortunately most of these had been in spirit from 10 to 13 years. One, the only comparatively fresh specimen, was brought in as spoil by the cat some seven months ago to Mr. David Morgan, of Bornholm (Albany-Denmark district), to whom I am very much indebted.

I desire also to express my thanks to Mr. Ellis Troughton through whose mediation I received a pair of *Tarsipes* which had been collected by Mr. Morgan and were intended for the Australian Museum, to Mr. Glauert of the Perth Museum, for a male specimen from that collection, and, in particular to Professor Nicholls who permitted me to make use of the small collection of *Tarsipes* presented by the late Mr. Hugh Leishman, of Nannup, to the W.A. University Museum, and who also offered much helpful criticism and advice during the process of the investigation.

Owing to the small size of the animal, dissection proved very difficult, even with the use of a binocular dissecting microscope, though it is very probable that had I had fresh material, I might have been able to write more positively upon certain points which must, for the present, continue to be doubtful.

As regards the external appearance there is nothing of importance to add to existing accounts of which there are already several. Gray², in the earliest published description of *Tarsipes* (1842), noted that the scrotum was very large which, indeed, is a fact that attracts attention even on a most superficial examination, being distinctly more than twice the size of that of a "pouched mouse"—*Sminthopsis murina*—an animal of slightly greater dimensions than *Tarsipes*. (Fig. 1). Gray, however, fails to call

(1) Description of Female U. G. organs of *Tarsipes rostratus*. P.L.S., N.S.W., Vol. XXV., p. 522.
(2) Ann. and Mag. N. H. Series 1, Vol. 1X., p. 40.

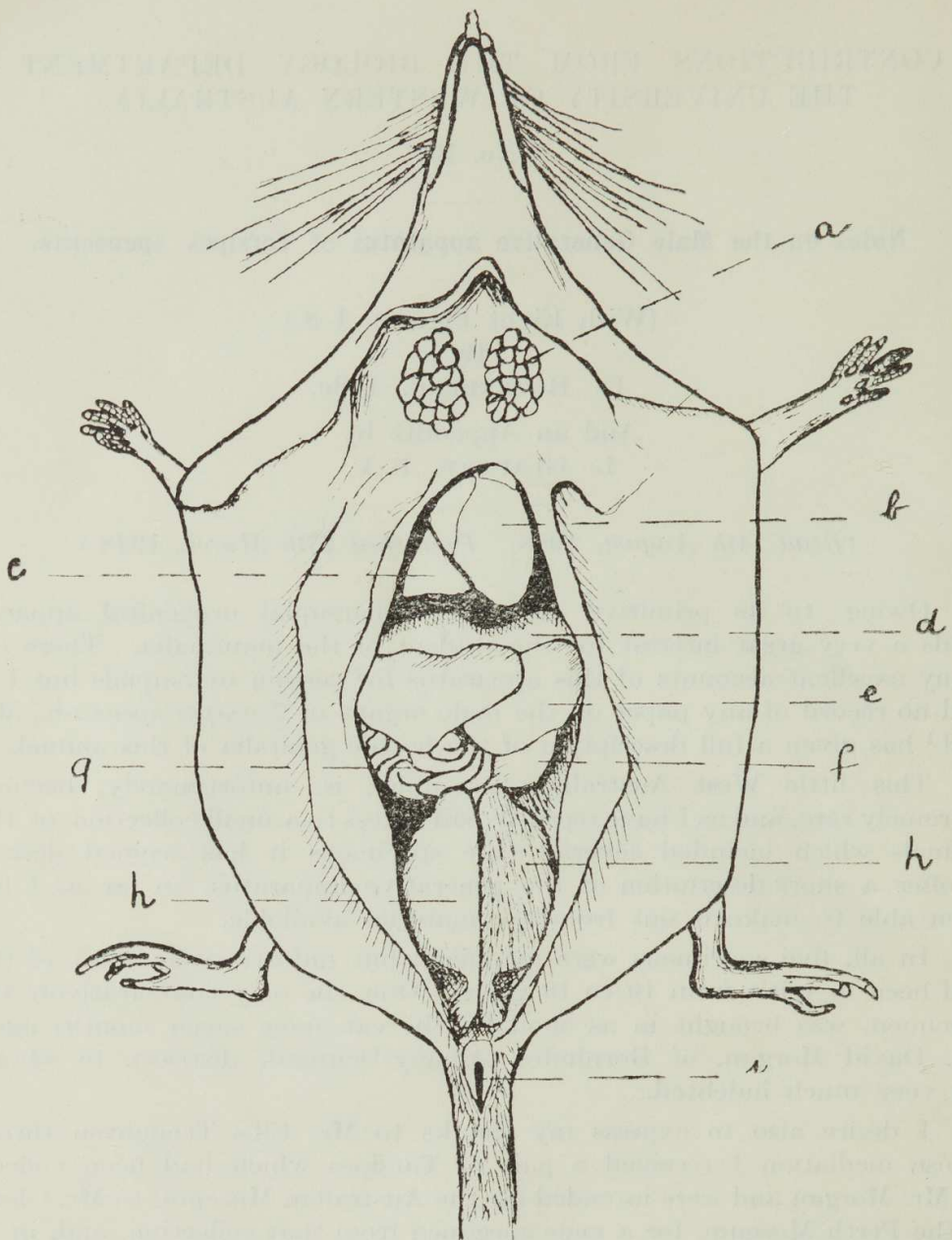


Fig. 1.

Figure 1.—*Tarsipes spenserae* ♂—general dissection (X 1½).

a, Thyroid gland; b, heart; c, lung; d, diaphragm; e, liver; f, stomach; g, intestines; h, testis with serotal sac removed; h1, serotal sac containing left testis; i, cloacal aperture.

attention to the unusual form of the serotal sac which, following the contours of the testis and large associated epididymis, is produced posteriorly into a smaller pyriform sac and anteriorly into a distinct bluntly conical extension. (Fig. 1. h¹.)

DETAILED DESCRIPTION.—At the outset it must be pointed out that owing to the smallness of the animal, the total length of the genitalia, measured from the anterior end of the bladder to the apex of the penis, was barely $\frac{3}{4}$ in. (20 mms.).

Bladder.—(Figs. 2, 3).—In all of my specimens the bladder was found in the contracted condition, but even so was unusually small when compared with the surrounding structures. Writing of *Thylacinus*, Cunningham² says “the bladder.....is remarkable for its small size,” but

(1) Zool. Challenger Exp., Vol. V., Part XVI., p. 164, and Plate X., Fig. 6. b.
 (2) op. cit. Pl. X., Figs. 6 and 8.

comparatively this organ is very much smaller in *Tarsipes*. In the specimen figured, which was typical, the bladder measured 2.5 mms. in length.

In shape ovoid, its walls thick and muscular, it is completely invested by peritoneum and is connected by a distinct mesentery to the dorsal abdominal wall. There was no trace of a urachus.

At its neck, which is thinner-walled, the bladder passes on to the dorsal surface of the broad anterior end of the extremely large prostate.

The mucous membrane lining the bladder was rather rugose, this rugosity disappearing in the region of the neck.

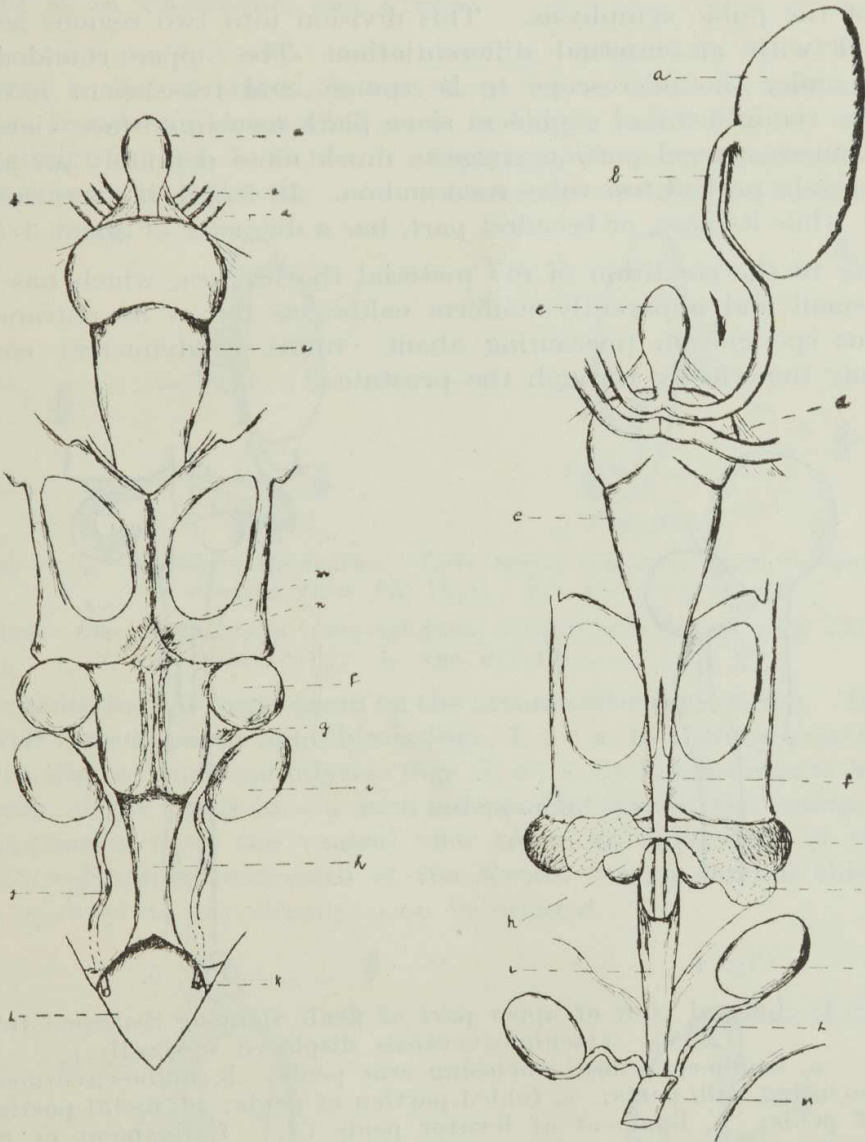


Fig. 2.

Figure 2.—*Tarsipes spenserae*—male genitalia—ventral view (X 4).

a, bladder; b, mesentery attaching bladder to dorsal abdominal wall; c, ureter; d, vas deferens; e, prostate; f, ischio cavernosis enclosing crus penis; g, bulbus cavernosis enclosing bulb penis; h, penis enclosed in preputial fold; i, anal gland; j, duct of anal gland; and k, its aperture; m, torn museles; n, aponeurosis formed by museles.

Fig. 3.

Figure 3.—*Tarsipes spenserae*—male urogenital system—dorsal view (X 4).

a, kidney; b, ureter; c, bladder; d, vas deferens; e, prostate; f, membranous urethra; g, ischio-cavernosis enclosing crus penis; h, bulbo-cavernosis enclosing bulb penis; i, penis; j, Cowper's gland; k, anal gland; and l, its duct; m, rectum.

The ureters (Fig. 3, b) enter the neck of the bladder one on each side of the mid dorsal line. Immediately posterior to these the vasa deferentia (Fig. 3, d) meet in the middle line and seem to enter the prostatic portion of the urethra in which respect they appear to differ from the condition featured by Cunningham² for *Thylacinus* and *Cocus*.

Prostate and Prostatic Urethra.—The prostate (Figs. 2, e; 3, e) is relatively a very large pyriform body, traversed by the urethra. It commences at the neck of the bladder by a broad base which bulges slightly and is then a little constricted. From this constriction it tapers away very gently to its posterior end upon the urethra in the region of the lowermost portion of the pubic symphysis. This division into two regions seems to correspond with an internal differentiation. The upper rounded mass appeared under the microscope to be spongy and translucent having an appearance reminiscent of a phloem sieve plate seen in surface view. The posterior, more conical portion suggests much more definitely an arrangement of closely packed test tubes seen end-on. In length it measures about 8.5 mms. while its base, or broadest part, has a diameter of about 3.5 mms.

Owing to the condition of my material the urethra, which has an extremely small and apparently uniform calibre as far as its entrance into the corpus spongiosum (measuring about .4mms. in diameter), could be traced only imperfectly through the prostate.

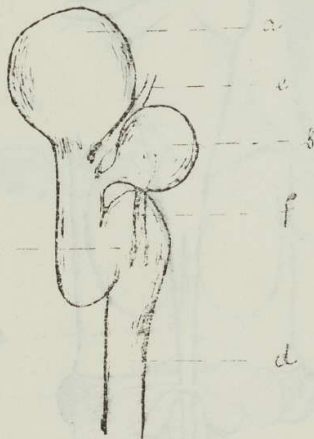


Fig. 4.

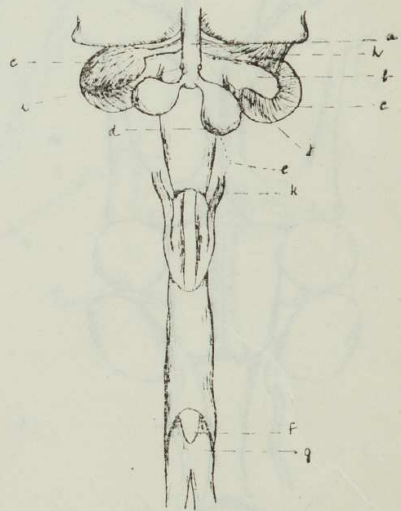


Fig. 5.

Figure 4.—Lateral view of upper part of penis showing S-shaped fold (X 8). (Ischio-cavernosis displaced upwardly.)

a, Ischio-cavernosis enclosing crus penis; b, bulbo-cavernosis enclosing bulb penis; c, folded portion of penis; d, distal portion of penis; e, ligament of levator penis (?); f, ligament of retractor penis.

Figure 5.—*Tarsipes spenserae*—dorsal view of penis (X 4). (Cowper's glands removed, portion of ischio-cavernosis of right side removed, folded portion of penis straightened out.)

a, membranous urethra; b, crus penis; c, ischio-cavernosis; d, bulb penis enveloped in bulbo-cavernosis; e, portion of penis formerly hidden by S-shaped fold; f, apex of penis; g, preputial fold; h, ligament connecting crus penis to pelvic girdle; i, openings of Cowper's glands into urethra; j, ligament of levator penis muscle (?); k, ligament of retractor penis muscle.

On cutting it open, the prostate was found to be a little more than 1mm. in thickness at its broadest part, and apparently composed of minute tubules, packed closely together like test tubes in a box, each opening independently into the membranous urethra. As mentioned above, even with the use of a binocular dissecting microscope it was only doubtfully that I could identify the openings of the ureters and vasa deferentia into the urethra and I am quite unable to say whether or no the veru-montanal eminence was present. Cunningham, likewise, in the much larger specimen of *Thylacinus*, was unable to recognise this papilla. Nor could any trace of a uterus masculinus be made out and quite probably this is lacking in *Tarsipes* as in *Thylacinus* and *Cuscus*.

Testes and Vasa Deferentia.—(Figs. 6, 7, 8).—The body of the testis, as before stated, is very large for so small an animal, is ovoid in shape, measuring about 12·5 mms. in length and 6·3 mms. in diameter. The epididymis (figs. 7, 8) too, is very large, abutting against the testis in such fashion as to make the conjoined structure within the tunica vaginalis

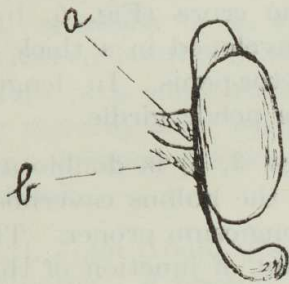


Fig. 6.

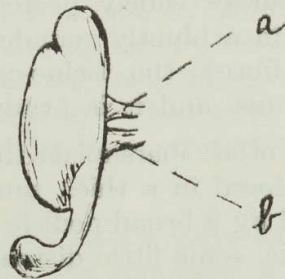


Fig. 6a.

Figure 6.—*Tarsipes spenserae*. Left testis removed from serotal sac; ventral view (X 1½).

Figure 6a.—Left testis removed from serotal sac; dorsal view (X 1½).
a, spermatic cord; b, vas deferens.

appear quite half as large again as the actual testis (figs. 6, 6a). In addition to a well formed caput epididymis (figs. 7, a; 8, b) there is present, almost equal in size, a cauda epididymis (figs. 7, c; 8, d) which projects freely from the body of the testis into a semi-independent sac of the tunica vaginalis, and appearing from the ventral view to be an appendage of the testis. The corresponding outgrowth of the serotal sac to contain this enlarged cauda epididymis has already been mentioned.

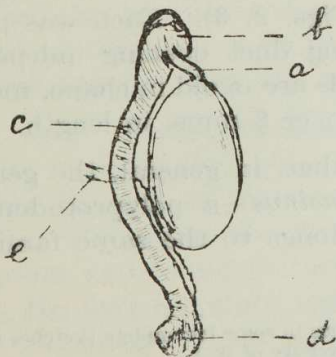


Fig. 7.

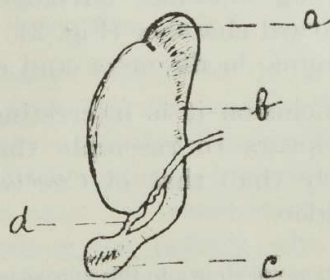


Fig. 8.

Figure 7.—*Tarsipes spenserae*. Left testis (dorsal view) with tunica vaginalis removed, showing attached epididymis (X 1½).
a, caput epididymis; b, epididymis; c, cauda epididymis; d, vas deferens.

Figure 8.—*Tarsipes spenserae*. Left testis (ventral) with epididymis slightly separated from body of testis (X 1½).
a, vasa efferentia; b, caput epididymis; c, epididymis; d, cauda epididymis; e, vas deferens.

The vas deferens (figs. 2, 3, 6) is a tube of uniform thickness less than .5mm. in diameter, and shows no related seminal vesicle. It penetrates the urethral wall close to the base of the prostate, immediately behind the point where the ureter disappears into the neck of the bladder.

Cowper's Glands.—(Fig. 3, j.)—A pair of these glands was present, one on either side of the middle line, each with a narrow duct opening dorso-laterally into the urethra just anterior to the point where it enters the tissue of the corpus spongiosum (fig. 5). Unlike those of *Thylacinus* and of *Cuscus* as described by Cunningham these glands appear to have no muscular investment and suggest a very loose vesicular structure.

Penis.—This consists as usual of three parts, viz., two corpora cavernosa and a corpus spongiosum, but there does not appear to be a distinct glans penis, the aperture suggesting that the three constituent structures are continued side by side to the apex (fig. 5). The preputial fold is attached firmly to the ventral wall of the cloaca. As in *Thylacinus* the corpora cavernosa separate widely posteriorly to form the crura (Fig. 5, b). Each crus ends in a bluntly rounded point and is enveloped in a thick layer of muscular fibres—the ischio-cavernosis or erector-penis. In length it is about 2 mms. and it is firmly attached to the pelvic girdle.

As in other marsupials the bulb-penis (Figs. 3, 5) is double and each half is enclosed in a thick muscular envelope—the bulbus cavernosis—and is attached by a broad pedicle to the corpus spongiosum proper. The body of the penis, some little distance behind the point of junction of the crura, is bent upon itself into an S-shaped fold lying in the dorsi-ventral plane (Fig. 4). In this folded retracted condition the length of the penis, measured from the junction of the crura to its apex, was about 6.5 mms.

Muscles of Penis.—The four pairs of muscles described by Cunningham for *Thylacinus*, viz., the ischio-cavernosi (Fig. 5, c) the bulbo-cavernosi (Fig. 5, d), the retractores penis (Fig. 5, k), and the levatores penis (Figs. 5, j; 4, e), with the exception of the last-named are the same for *Tarsipes*. These, however, could only be imperfectly recognised. A pair of ligaments (Fig. 4, e) attached to the lateral surface of the penis just below the bulb and possibly connected to muscles arising from the ventral surface where the two crura join, was all that could be traced.

Anal Glands.—There were present only one pair of anal glands in both male and female, one on each side (Figs. 2, 3). Each was provided with a strong muscular envelope and a long duct opening independently into the cloacal chamber (Fig. 2). The glands are ovoid in shape, measuring about $1\frac{1}{2}$ mms. in diameter and somewhat over 2 mms. in length.

In conclusion it is interesting to note that, in general, the genital apparatus appears to resemble that of *Thylacinus*—a polyprotodont much more closely than that of *Cuscus* which belongs to the same family, viz., Phalangeridae.

(5) Attention was drawn to this appendage-like appearance in some incomplete sketches of *Tarsipes* by Mr. K. C. Richardson, M. Sc., a former student of the University of W.A.